

HAZARDOUS SUBSTANCES EMERGENCY EVENTS SURVEILLANCE

# HSEES

## CUMULATIVE REPORT

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JANUARY, 1993 - DECEMBER, 1997

*February, 2000*



**INTRODUCTION:** The HSEES system is a computerized database used to monitor the acute public health consequences of emergency hazardous substance releases into the environment. The system does not study chronic human health effects or the non-human effects of these releases. HSEES is used to describe the morbidity and mortality experienced by employees, responders, and the general public that results from hazardous substance emergency events. The system documents all reportable hazardous substance releases in the state except for those involving only petroleum products (for example, natural gas, propane, jet fuel, and gasoline). HSEES events can occur at fixed facilities or during transportation. See inside.

There are four objectives of the Hazardous Substances Emergency Events Surveillance system. These are:

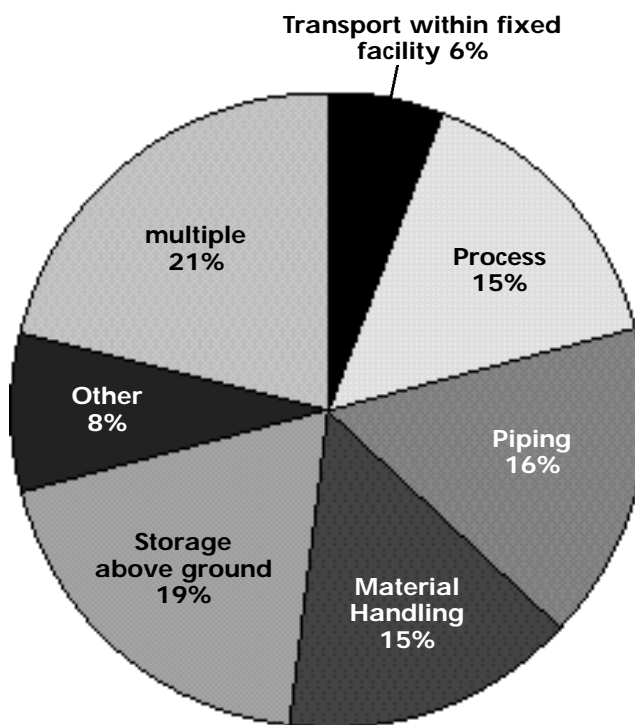
- To describe the distribution of hazardous substance emergency events within the state.
- To describe the morbidity and mortality experienced by employees, responders, and the general public that results from hazardous emergency releases.
- To analyze and describe risk factors associated with the morbidity and mortality.
- To develop strategies to reduce the subsequent morbidity and mortality.

Emergency events captured by HSEES are classified according to whether they occur at fixed facilities (for example, factories) or during transportation. They are uncontrolled or illegal releases that would require removal, cleanup, or neutralization according to federal, state, or local law. Threatened releases are included in the system if they involve actions such as evacuations which are taken to protect the public health. A substance is considered hazardous if it can be reasonably expected to cause death or injury upon exposure.

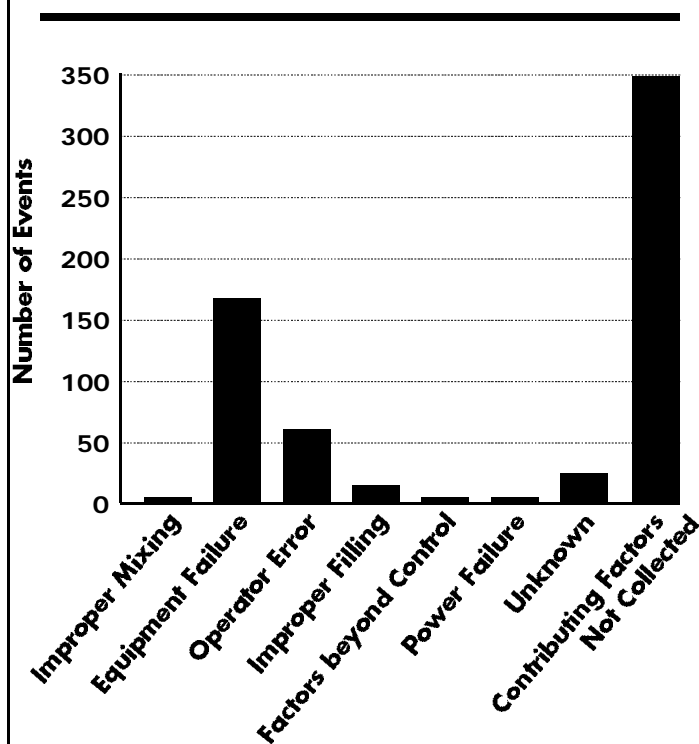
## RESULTS

Data collection is complete for the five-year period from January 1, 1993 through December 31, 1997. Eight hundred forty-eight events occurred in Alabama in this time period. Of these, about 2% were threatened releases. Approximately 81% occurred at fixed facilities and 19% were transportation related.

Fifteen percent of fixed facility events were reported to occur in process vessels which are chambers where reactions are contained during manufacture (Figure 1). Nineteen percent of fixed facility events were releases from above ground storage structures, sixteen percent involved piping and valves, and fifteen percent happened during material handling such as loading and unloading. The remaining 35% of events involved ancillary processing, heating and cooling, waste processing, or multiple areas in the facility. The two most common factors contributing to fixed facility releases were equipment failure and human error (Figure 2). Contributing factor information was not collected until later in the study period. Additionally, new categories such as power failure, maintenance, system startup, deliberate damage, and factors beyond human control have been added to the field. It is expected that the new information will give the data more practical applications.

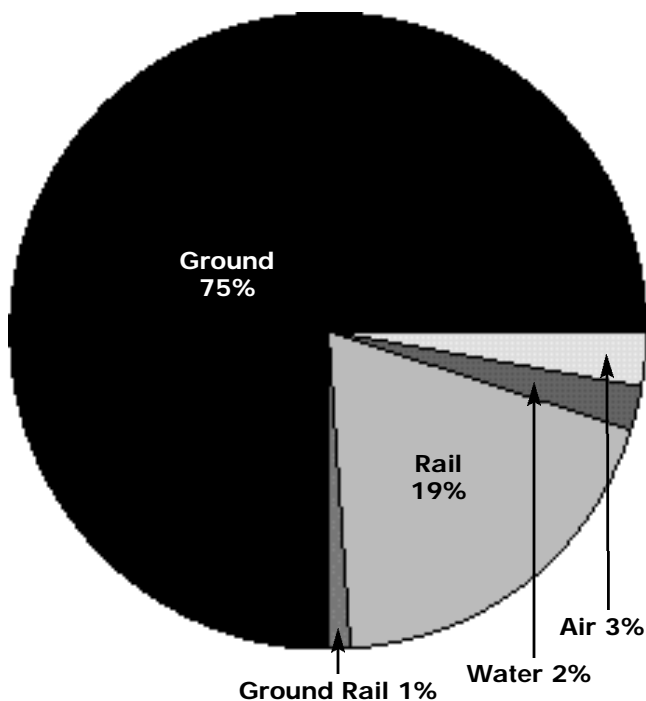


**Figure 1.** Areas of fixed facilities involved in events, AL Hazardous Substances Emergency Events Surveillance, 1993-1997.



**Figure 2.** Factors reported as contributing to the occurrence of fixed-facility events, Hazardous Substances Emergency Events Surveillance, 1993-1997.

In transportation events, seventy-five percent were classified as ground or highway, nineteen percent were rail, three percent were during air transportation, and two percent were on water (Figure 3). In 29% of the transportation events, there was a potential for motorists to be exposed to the material released by driving on the road where the release occurred or on an adjacent road, or by being caught in a traffic jam caused by the event. Approximately 20% of transportation events happened under adverse weather conditions compared to only 16% of fixed facility events.



**Figure 3.** Distribution of transportation events by type of transportation, Hazardous Substances Emergency Events Surveillance, 1993-1997.

## SUBSTANCES

Alabama HSEES data is categorized into eleven substance categories (Table 1). The catchall category of Other was the most common in both transportation and fixed facility releases. This category will require further grouping in order to examine the data more completely. Of the remaining groups, Other Inorganics were the most common substances in both fixed facility and transportation releases. Pesticides, which comprised 5.7% of total releases, were represented at a disproportionately higher percentage in transportation releases (11.9%). Ammonia comprised 7.4% of total releases and, yet, only 1.7% of transportation releases. Chlorine is similarly underrepresented in transportation releases, 1.7% versus 5.6% of total releases. Ammonia was the most frequently released chemical (n = 67) during this period (Table 2). It was followed by chlorine (n = 51), sodium hydroxide (n = 42), sulfuric acid (n = 40), and sulfur dioxide (n = 37).

1. Ammonia (67)
2. Chlorine (51)
3. Sodium Hydroxide (42)
4. Sulfuric Acid (40)
5. Sulfur Dioxide (37)
6. Methyl Mercaptan (29)
7. Hydrochloric Acid (25)
8. PCBs (21)
9. Potassium Hydroxide (15)
10. Ethylene Glycol (15)

**Table 2.** Ten most frequently released chemicals, 1993-1997.

Substance Category	Fixed Facility		Transportation		All Events	
	Number of Substances	%	Number of Substances	%	Number of Substances	%
Acids	74	10.0	27	15.3	101	11.0
Ammonia	65	8.8	3	1.7	68	7.4
Bases	44	6.0	44	6.0	63	6.9
Chlorine	48	6.5	3	1.7	51	5.6
Mixture of Categories	8	1.1	5	2.8	13	1.4
Other Inorganics	130	17.6	27	15.3	157	17.2
Paints & Dyes	11	1.5	6	3.4	17	1.9
Pesticides	31	4.2	21	11.9	52	5.7
PCBs	17	2.3	5	2.8	22	2.4
VOCs	130	17.6	7	4.0	137	15.0
Other	180	24.4	54	30.5	234	25.6
Total	738	100.0	177	100.0	915	100.0

**Table 1.** Number of substances released by substance category, 1993-1997.

## VICTIMS

There was a total of 361 victims in 103 individual events (Table 3). More than half of the events in which injuries or death occurred involved only one victim (51.5%). However, a total of 191 people were injured or killed in 12 events each of which involved more than six people. Efforts to reduce morbidity and mortality should focus on fixed facility events since approximately 80% of the victims were injured in fixed facility releases and 71% of the events in which there were victims occurred in fixed facilities.

Chlorine displayed a marked tendency to cause symptoms upon exposure in this data set. While chemical events involving chlorine comprise 17.4% of the total events where injury occurred, chlorine releases were only 5.6% all releases (Table 4). Moreover, approximately thirty-nine percent of all chlorine releases had victims. The tendency for injury to occur during chlorine releases was over twice that of ammonia (19.3%) and acids (16.8%).

Number of Victims	Fixed Facility			Transportation			All Events		
	# of Events	%	# of Victims	# of Events	%	# of Victims	# of Events	%	# of Victims
1	35	47.9	35	18	60.0	18	53	51.5	53
2	10	13.7	20	8	26.7	16	18	17.5	36
3	6	8.2	18	0	0.0	0	6	5.8	18
4	8	11.0	32	1	3.3	4	9	8.7	36
5	2	2.7	10	1	3.3	5	3	2.9	15
6	2	2.7	12	0	0.0	0	2	1.9	12
>6	10	13.7	159	2	6.6	32	12	11.7	191
Total	73	100.0	286	30	100.00	75	103	100.0	361

**Table 3.** Distribution of the number of victims by type of event, 1993-1997.

Substance Category	Number of Releases		Number of Releases With Victims		Percent of Releases In This Category With Victims
		%		%	
Acids	101	11.0	17	14.8	16.8
Ammonia	68	7.4	11	9.6	16.2
Bases	63	6.9	5	4.3	7.9
Chlorine	51	5.6	20	17.4	39.2
Mixture of Categories	13	1.4	1	1.4	7.7
Other Inorganics	157	17.2	19	16.5	12.1
Paints & Dyes	17	1.9	3	2.6	17.6
Pesticides	52	5.7	7	6.1	13.5
PCBs	22	2.4	0	0.0	0.0
VOCs	137	15.0	8	7.0	5.8
Other	234	25.6	24	20.9	10.3
Total	915	100.0	115	100.0	12.6

**Table 4.** Number of substances released in all events with victims, by substance category, 1993-1997.

More employees were injured in both transportation and fixed facility events than any other population group. Of the 93 responders who were injured, thirty-three percent were injured in transportation events even though only 19.3% of the total releases are transportation related (Figure 4). The rate of injury to responders in transportation events is nearly twice the rate for all population groups combined (36% vs. 20%).

HSEES collected data on 577 injuries during the study period, 1993-1997 (Figure 5). This amount does not equal the total number of victims during this period since some victims may have had more than one type of injury, e.g. headache and eye irritation. Respiratory irritation was the most commonly reported type of injury, both in the combined data and in each type of

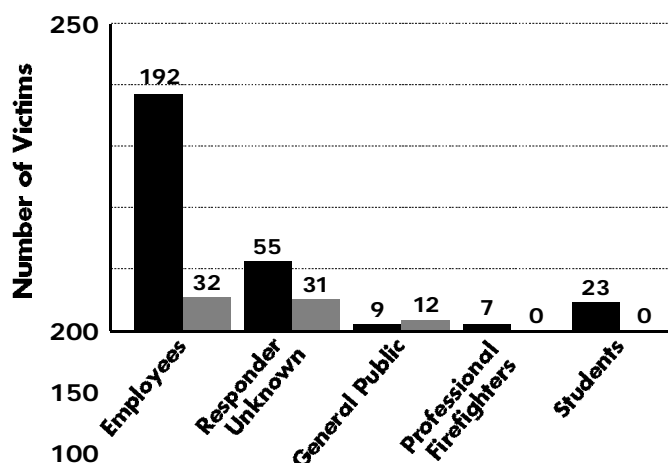
event, fixed and transportation. Headache, gastrointestinal symptoms, eye irritation, dizziness and other central nervous system symptoms, and skin irritation were often present, as well. Trauma represented 21% of the transportation related injuries (Table 5). It should be noted that, in these cases, the trauma is often the result of motor vehicle collisions, not hazardous substance exposure or explosions.

One hundred sixty-four (45%) of the victims were evaluated in hospital emergency rooms, treated, and then released (Figure 6). Seventy (19%) were admitted to the hospital due to their injuries and eighty-one (22%) were treated on the scene. A few victims, ten (3%), were seen by their personal physicians a later time. There were four deaths in hazardous substance emergency events during this five year period.

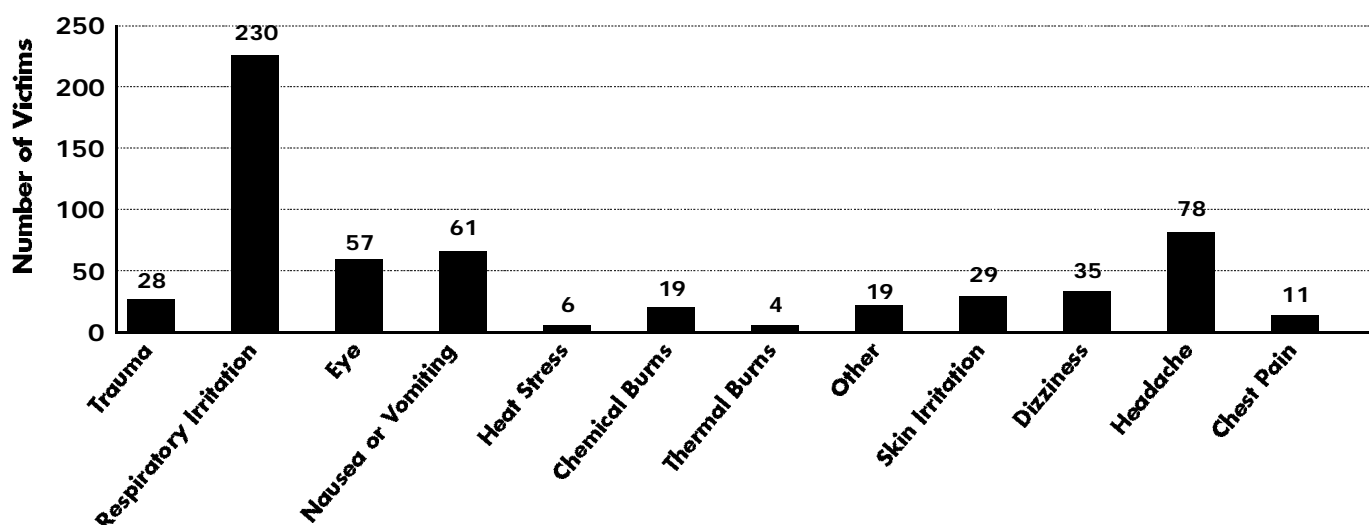
## EVACUATIONS

Evacuations were ordered in 115 events which is 13.6% of the total. The median number of people evacuated was 50. Twenty-five percent of the evacuations involved 15 people or less and seventy-five percent involved 150 people or less. The maximum number of people evacuated in a single event approached 2000.

Forty-two percent of the evacuations were of a building or the effected part of a building, thirty-nine percent were of a defined circular area around the release, ten percent were determined by wind or current direction, and six percent had no definite plan. The remainder of the evacuation plans were a combination of some or all of the preceding factors.



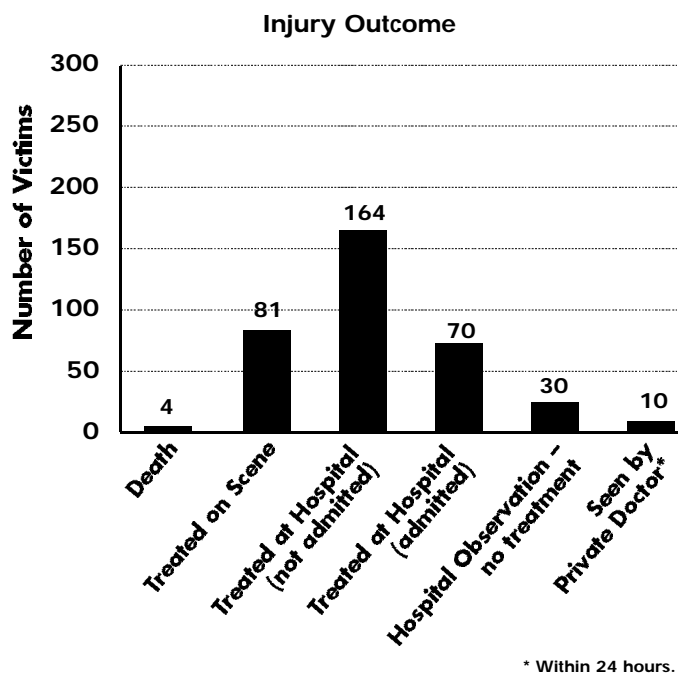
**Figure 4.** Distribution of victims by population group and type of events, AL Hazardous Substances Emergency Events Surveillance, 1993-1997.



**Figure 5.** Distribution of type of injury for all events, AL Hazardous Substances Emergency Events Surveillance, 1993-1997.

Type of Injury	TYPE OF EVENT				ALL EVENTS	
	<u>Fixed Facility</u>		<u>Transportation</u>			
	Number of Injuries	%	Number of Injuries	%	Number of Injuries	%
Chemical Burns	18	1	1	1	19	3
Chest Pain	6	1	5	4	11	2
Dizziness/CNS	30	7	5	4	35	6
Eye Irritation	43	9	14	12	57	10
Headache	68	15	10	8	78	14
Heat Stress	2	1	4	3	6	1
Nausea or Vomiting	43	9	18	15	61	11
Respiratory Irritation	199	44	31	26	230	40
Shortness of Breath	6	1	0	0	6	1
Skin Irritation	22	5	7	6	29	5
Thermal Burns	4	1	0	0	4	1
Trauma	3	1	25	21	28	5
Other	13	3	0	0	13	2
Total	457	100	120	100	577	100

**Table 5.** Distribution by type of event, 1993-1997.



**Figure 6.** Injury outcome, AL Hazardous Substances Emergency Events Surveillance, 1993-1997.

## SUMMARY

Cumulative data is listed by year in Table 6. Alabama averaged approximately 170 hazardous substance releases per year during the five year period of 1993 through 1997. The percentage of events with victims has remained relatively constant during this time as reflected in the last column of Table 6. This percentage is computed by dividing the number of events with victims for the year by the total number of

events. The decrease in total releases in 1997 is suspected to be due to underreporting but some year-to-year variation is to be expected. Very few deaths occurred due to hazardous substance releases in this time period and most of these were due to trauma associated with motor vehicle accidents.

The state's two most populous counties, Jefferson and Mobile, had the greatest number of hazardous substance releases with 109 and 184, respectively (Table 7). The Mobile Metropolitan Area contains the state's only seaport and active state docking facility, as well as being home to a large number of chemical manufacturers and oil and natural gas processing facilities. Birmingham, located in Jefferson County, is the states largest metropolitan area and is a regional transportation hub. The Huntsville Metropolitan Area in Madison County had relatively few releases during this period. This anomaly is possibly the result of the city's being slightly off the route of any interstate highway. Morgan and Colbert Counties had a disproportionately high frequency of events reflecting the concentration of chemical manufacturing and metallurgical processing facilities there.

These data are distributed to responders, industry, emergency management agencies, and other interested parties with the intent of aiding their emergency planning activities. Information from the project is available to any interested citizens of the state upon request. The HSEES project will begin a prevention outreach plan in the year 2000. The compilation of this five year cumulative analysis was performed to help develop strategies for the prevention outreach plan with the ultimate goal of reducing subsequent morbidity and mortality from hazardous substance emergency events.

Year	TYPE OF EVENT			Number of Deaths	Number of Victims	Events With Victims	
	Fixed Facility	Transportation	Total				%
1993	117	30	147	0	80	18	12
1994	136	30	166	1	77	18	11
1995	145	38	183	1	80	26	14
1996	166	37	203	2	81	22	11
1997	121	28	149	0	43	19	13
Total	685	163	848	4	361	103	12

**Table 6.** Cumulative data for Alabama, 1993-1997.

Event County	Fixed Facility		Transportation		Total Number of Events
	Number of Events	%	Number of Events	%	
Autauga	6	100.0	0	0	6
Baldwin	5	71.4	2	28.6	7
Barbour	3	75.0	1	25.0	4
Bibb	2	100.0	0	0	2
Blount	3	75.0	1	25.0	4
Bullock	0	0	1	100.0	1
Butler	1	50.0	1	50.0	2
Calhoun	16	100.0	0	0	16
Cherokee	1	50.0	1	50.0	2
Chilton	0	0	1	100.0	1
Choctaw	3	100.0	0	0	3
Clarke	1	50.0	1	50	2
Clay	1	50.0	1	50.0	2
Coffee	5	71.4	2	28.6	7
Colbert	42	89.4	5	10.6	47
Conecuh	3	42.9	4	57.1	7
Coosa	2	100.0	0	0	2
Covington	2	66.7	1	33.3	3
Cullman	5	45.5	6	55.5	11
Dale	3	75.0	1	25.0	4
Dallas	13	81.3	3	18.7	16
Dekalb	7	58.3	5	41.7	12
Elmore	1	100.0	0	0	1
Escambia	8	72.7	3	27.3	11
Etowah	10	71.4	4	28.6	14
Fayette	2	100.0	0	0	2
Franklin	0	0	3	100.0	3
Geneva	2	40.0	3	60.0	5
Greene	1	33.3	2	66.7	3
Hale	2	100.0	0	0	2
Henry	1	50.0	1	50.0	2
Houston	14	70.0	6	30.0	20
Jackson	8	88.9	1	11.1	9
Jefferson	91	83.5	18	16.5	109
Lamar	2	66.7	1	33.3	3
Lauderdale	5	71.4	2	28.6	7
Lawrence	11	84.6	2	15.4	13

**Table 7.** Number of events by county and type of event, 1993-1997.

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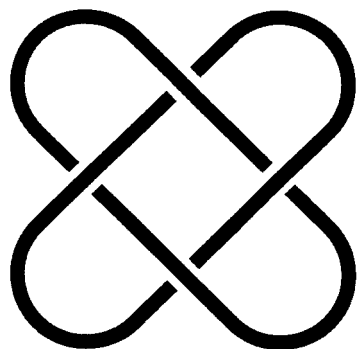
Lee	4	80.0	1	20.0	5
Limestone	4	50.0	4	50.0	8
Lowndes	12	92.3	1	7.7	13
Macon	0	0	2	100.0	2
Madison	8	88.9	1	11.1	9
Marengo	2	40.0	3	60.0	5
Marion	2	40.0	3	60.0	5
Marshall	11	91.7	1	8.3	12
Mobile	173	94.0	11	6.0	184
Monroe	6	85.7	1	14.3	7
Montgomery	17	85.0	3	15.0	20
Morgan	63	92.6	5	7.4	68
Pickens	1	33.3	2	66.7	3
Pike	1	100.0	0	0	1
Randolph	2	66.7	1	33.3	3
Russell	2	66.7	1	33.3	3
Shelby	6	60.0	4	40.0	10
St. Clair	0	0	4	100.0	4
Sumter	24	80.0	6	20.0	30
Talladega	5	38.5	8	61.5	13
Tallapoosa	2	100.0	0	0	2
Tuscaloosa	20	76.9	6	23.1	26
Walker	2	18.2	9	81.8	11
Washington	26	89.7	3	10.3	29
Wilcox	9	100.0	0	0	9
Winston	1	100.0	0	0	1
Total	685	80.8	163	19.2	848

**Table 7.** Number of events by county and type of event, 1993-1997.

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Alabama Department of Public Health  
Division of Epidemiology  
434 Monroe Street  
Montgomery, Alabama 36130-3012

## DIVISION OF EPIDEMIOLOGY



## RISK ASSESSMENT BRANCH

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This publication was supported by Cooperative Agreement Number 498047 from ATSDR. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of ATSDR.